

A CASE OF CERVICAL PARAPLEGIA FROM DISLOCATION—AUTOPSY.¹

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THE following is the history of a case of cervical paraplegia from dislocation forward of the sixth cervical vertebra upon the seventh. The patient was in the Presbyterian Hospital in the service of Dr. Briddon, to whom I am indebted for an opportunity of examining the case.

J. F., a mason, fifty-seven years of age, fell head first from a scaffolding on the morning of October 9, 1889, a distance of twelve feet.

His head struck against a board, but precisely in what manner is not known.

When found the patient lay on his back in great agony. He referred his pain to his neck.

On admission to the hospital the patient was still fully conscious. Respiration was purely diaphragmatic. The pulse was good. Temperature 97.2°

A careful examination failed to elicit evidence of fracture or dislocation in any part of the cervical spine. It was noted, however, that there was great tenderness to pressure over the sixth and seventh cervical vertebræ.

The house-surgeon, Dr. Sharpe, states that when first admitted the patient was observed to have good use of his forearms and arms, although he was completely paraplegic below the upper extremities, and the fingers were weak. There were also complete anæsthesia and analgesia of the lower extremities, and of the trunk as high as the seventh cervical vertebra behind, the exact upper limit of the sensory loss anteriorly not having been noted. The loss of sensibility also involved the ulnar border of either upper extremity.

¹ Read before the New York Neurological Society, 1889.

With the exception of the plantar reflex of the left side, both superficial and deep reflexes were absent when the patient first came under observation.

Nine hours after the admission of the patient an examination was made to determine with exactness the distribution of the motor and sensory paralysis, in order to learn the upper level of the lesion in the cord.

There was complete paralysis of motion below the level of the upper extremities. In the upper extremities themselves there was complete loss of power in the intrinsic muscles of the hand and interossei, in the flexors and extensors of the wrist and in the triceps. There was slight loss of power in the pronators and supinators, and considerable weakness of the biceps. The weakness of the biceps was more pronounced on the left than on the right side; in other respects the distribution of the motor loss was highly symmetrical.

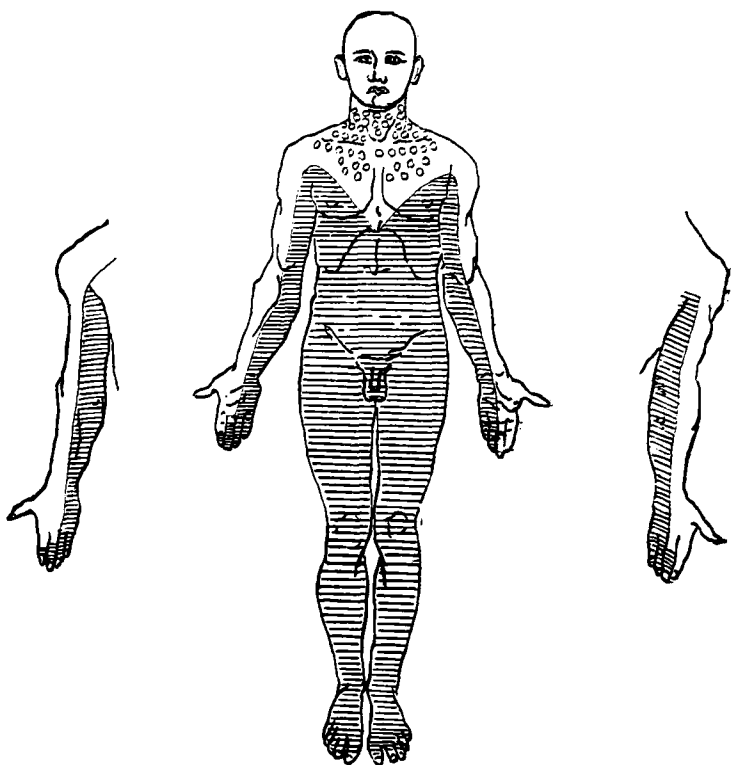
The house-surgeon stated that the weakness of the biceps at the time of this examination was distinctly greater than three hours before, and also that the muscles of the hand were involved before those of the forearm. The triceps was involved before the biceps. The pectoralis major showed some loss of power.

The deltoids, trapezii, and the muscles of the head and back were normal.


The sensory loss also presented a high degree of symmetry. The anæsthesia and analgesia involved, roughly speaking, the distribution of the ulnar, internal cutaneous and lesser internal cutaneous nerves in the arm.

On the anterior aspect of the chest the upper border of the anæsthetic area is indicated on either side by a line beginning about two inches above the axillary border and passing through the fourth rib in the mammary line to the lower end of the gladiolus.

The accompanying diagram represents with exactness the distribution of the sensory loss. It is to be noted that while on the arms and chest the symmetry is striking, on the hands there is some irregularity of distribution. On the right side the loss of sensibility involves the palmar surface



 *Area of Anæsthesia and Anelgesia.*

 *Area of Hyperalgesia.*

of the little ring and middle fingers, and of the third phalanx of the index finger. On the dorsal surface of the hand it involves only the little and ring fingers, with the second and third phalanges of the middle finger. The left hand shows loss of sensibility on the palmar aspect of the little and ring fingers and on the dorsal surfaces of the same fingers. In addition the loss involves the posterior surfaces of the second and third phalanges of the middle finger, and of the third phalanx of the index finger.

There was a cincture pain about the lower part of the neck. Just above and below the clavicles the skin was hyperalgesic.

Below the neck there was most pronounced myoedema. Fibrillary contractions could be elicited very readily below the neck, by light percussion, but the mechanical irritability of the muscles was greatest in the upper extremities.

Both deep and superficial reflexes were absent as before, and there was retention of urine.

The sense of posture was lost in the lower extremity and trunk. The temperature sense was not tested. When observed the pupils were nearly equal and of moderate size. Their reaction to light and during accommodation was not noted. The position assumed by the upper extremities is of interest, corresponding as it does very nearly with the position observed by Thorburn in cases of injury below the fifth cervical nerve-root. Both arms were slightly abducted, and the forearms tended to assume a position of flexion and supination. There was no external rotation of the arm, and when the forearm was placed in a position of full extension it remained so.

During the afternoon of the 9th the temperature rose to 104° . The pulse continued to be fair in strength. Respiration diaphragmatic.

On October 10th the patient's condition was not materially changed, except that the biceps was perhaps feebler. During the afternoon of this day the respiration became embarrassed, and at 6.30 on the morning of the 11th, the patient died from respiratory failure, having survived the accident about forty hours.

The diagnosis of the position of the upper level of the injury to the cord was based on the distribution of the motor and sensory loss. The distribution of the anæsthesia in the upper extremities corresponds closely with that attributed by Ross² and by Thorburn³ to destruction of the eighth cervical and first dorsal segments of the cord. The sensory indications, therefore, pointed to the lower end of the seventh cervical segment as the upper limit of the lesion. The indications derived from the fully developed motor palsy placed the upper level of the considerably higher in the cord, for in addition to the slight weakness developed in the pronators, supinators, and pectoralis major, there was decided though not absolute loss of power in the biceps.

According to Thorburn⁴, the biceps is represented in the fifth cervical nerve, and in Starr's⁵ recent table it is given as derived from the fourth, fifth and sixth segments of the cord. Hence, the lesion causing the fully developed paralysis was argued to have extended at least as high as the sixth segment. But, when the patient was admitted, the muscles of the hand only were parietic, and as these are supposed to be represented in the eighth cervical and first dorsal segments the indications derived from the original motor and sensory loss showed a close agreement.

The upward extension of the paralysis was so rapid and occurred so soon after the injury that it was not attributed to an ascending myelitis. Moreover, the sensory paralysis remained stationary while the motor loss ascended, and it was thought probable that the damage to the nerve elements above the eighth cervical segment was incomplete and perhaps referable to pressure from bone or to hæmorrhage into the cord, or to both, occurring soon after the original damage. In view of these considerations the upper level of the original damage was located in the seventh cervical segment.

² On the Segmental Distribution of Sensory Disorders. *Brain*, Jan., 1888.

³ Cases of Injury to the Cervical Region of the Spinal Cord. *Brain*, Jan., 1887.

⁴ Spinal Localizations as Indicated by Spinal Injuries. *Brain*, Oct., 1888.

⁵ Syringomyelia: its Pathology and Clinical Features. Table, p. 464. *Am. Jour. Med. Sci.*, May, 1888.

The autopsy, which was conducted less than twelve hours after death by Dr. Thacher, revealed a dislocation forward of the sixth cervical vertebra upon the seventh, and an oblique fracture through the left superior articular process of the sixth cervical vertebra. The extent of the forward displacement of the sixth vertebra upon the seventh was probably not more than one-third of an inch, if we may judge by the latitude of movement at the autopsy. How much pressure was being exerted on the cord at the time of the autopsy, it is impossible to say, but there seems to have been some displacement.

The vessels of the pia near the level of the dislocation were fuller than above and below, and the left anterior root of the eighth nerve was torn across. No other extra-medullary change could be detected.

The consistence of the cord was very much diminished throughout the eighth segment, and the gross appearance of the lower end of this segment was indicative of extensive disintegration of the nervous elements. The seventh segment was also decidedly soft, though less so than the eighth. Above and below these segments the consistence of the cord seemed quite normal. At the junction of the sixth and seventh segments the central canal was much distended by hæmorrhage, and this central hæmorrhage was discernible as high as the upper end of the sixth segment, but at this level there is a very slight increase only in the size of the canal.

The ascent of the motor symptoms in this case seems referable either to the hæmorrhage into the cord or to post-traumatic pressure on the seventh segment of the cord, causing sufficient damage to produce motor without sensory symptoms. If the latter mechanism be the explanation of the spread of the motor loss, it must be admitted that the sensory palsy is due entirely to the injury of the eighth segment, since the anæsthesia remained stationary. But it is perhaps more reasonable to suppose that both the seventh and eighth segments were damaged simultaneously by the original trauma. In this case the sensory loss might be referable to the injury of the seventh segment as

well as the eighth, and the subsequent motor paralysis could then be explained only on the supposition that the central hæmorrhage and slight infiltration were adequate to damage the anterior horns.

Supposing the hæmorrhage in the region where the distension of the canal is considerable, and there is some extravasation into the surrounding gray substance, to have been operative in the production of paralysis, we cannot refer any symptoms to a higher level than the junction of the sixth and fifth segments, and it is very doubtful whether the hæmorrhage observed in the upper half of the sixth segment could have been a factor.

So far, therefore, as we can draw any inferences regarding the localization of the motor and sensory functions of the cervical cord from a single case, these are, with one exception, in support of the conclusions reached by Thorburn from the study of a considerable number of cases of injury in this region. The exception relates to the representation of the biceps muscle. The fifth segment of the cord is intact in this case, and it is questionable whether the changes in the upper half of the sixth segment can be made responsible for any motor loss. Yet the biceps was all but completely paralyzed on both sides. We are thus led to the conclusion that in this case the biceps was largely represented in a part of the cord at least as low as the lower half of the sixth cervical segment.

The involvement of the intrinsic muscles of the hand before the flexors and extensors of the wrist, and of the triceps before the biceps, corresponds in a general way with the vertical arrangement of the cervical nuclei as tabulated by Thorburn. The pronators and supinators were involved before the biceps, though just when was not noted, and they were much less paralyzed than the biceps, which is supposed to have a more cephalad representation. If the nuclei were arranged in simple vertical series without horizontal differentiation or vertical overlapping, such partial immunity would probably not occur in lesions of this kind.

And upon this point we must offer a word of criticism upon Thorburn's valuable work, in that he seems to have overlooked the important horizontal differentiation which certainly exists, in an attempt to establish the vertical relationship of the nuclei. In Starr's table the extensive vertical representation of some of the muscle nuclei is taken into consideration.

I put this case upon record, not because it presents any remarkable features, but because the number of cases of this kind, with autopsy, is still small, and every isolated instance may be of some aid in the localization of future lesions of the cervical cord.